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**Forest Service**

# Forestry Research West

September 1994

A report for land managers on recent developments in forestry research at the four western Experiment Stations of the Forest Service, U.S. Department of Agriculture.

# Forestry Research West

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## Cover

The deer mouse has been pinpointed as the main host for the sometimes deadly Hantavirus disease. Exposure to the mice, their droppings and the general environment where they live can be hazardous. Read about how Forest Service researchers are taking precautions, beginning on page 6.

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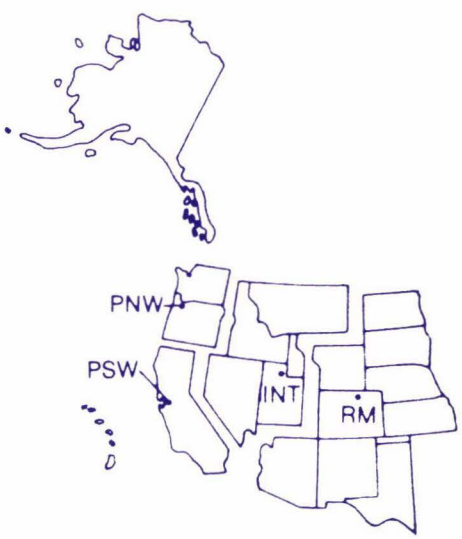
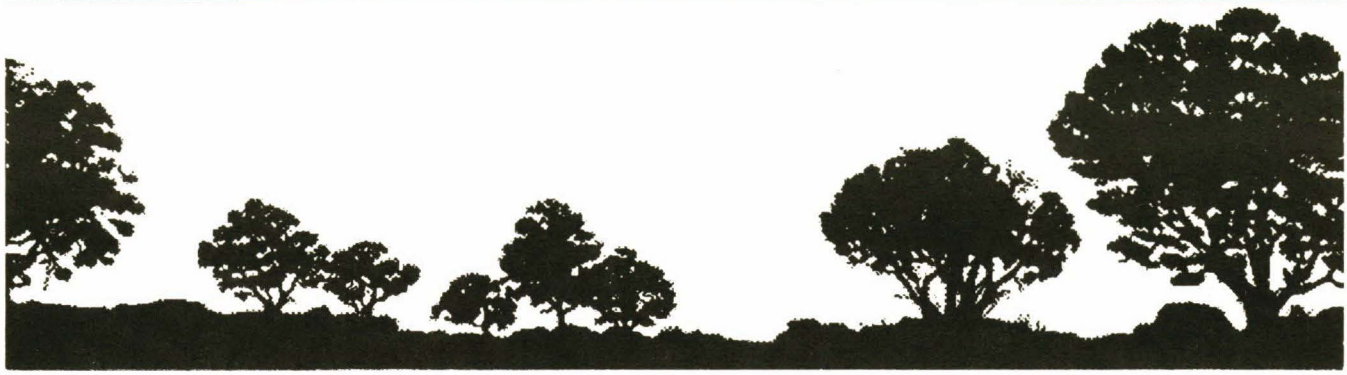


# P-J in the SW: how best to manage?

by Gerald Gottfried,
Kieth Severson and
Rick Fletcher
Rocky Mountain Station



There are approximately 47 million acres of pinon-juniper woodlands in the U.S., most occurring in the West. This ecosystem is particularly prevalent and important in Arizona and New Mexico, and is the most common vegetation type in the USDA Forest Service's Southwestern Region. Depending on site and stand conditions, pinon-juniper (P-J) woodlands often produce fuelwood, pinon nuts, wildlife habitat, forage for livestock, and cover for watershed protection. They have also been mired in controversy during the past 50 years, centering around differences of opinion as how to best manage this important ecosystem. One controversy surrounds the distribution of woodlands prior to European settlement and changes since the introduction of livestock and fire control. This issue relates to whether woodlands are invading grasslands, or to a lesser extent, drier ponderosa pine forests. Other questions center around whether these lands should be managed for single or multiple resources. And recent concerns involve the consideration of increasing recreational demands, threatened and endangered species, and cultural resources.

There is a growing interest and demand for multiresource management that will ensure healthy and sustainable P-J ecosystems. Unfortunately, there's still much to learn about the ecology of these woodlands and the potential impacts of different management options.

Research Forester Gerald Gottfried, with the Rocky Mountain Station's Southwest Forest Science Complex in Flagstaff, AZ, says that one of the most persistent questions is whether these woodlands are invading true grasslands to the detriment of range and watershed resources. He indicates that many of the "invaded" grasslands are climatically woodlands, and should be classified as juniper savannahs. "Fire was the most important natural disturbance in the P-J woodlands prior to European settlement," he says.

"Grass fires maintained some sites as juniper 'savannahs' and grassland inclusions because they tended to kill trees less than 3 feet tall. Spanish colonists introduced cattle and other livestock into the woodlands during the 16th century, and their numbers increased dramatically in the 1880's as settlers later began ranching operations throughout the West."

Large herds exceeded the carrying capacity of most ranges and overgrazing was common. The loss of a continuous herbaceous cover had serious consequences. One was that fires did not have sufficient fuels to carry through stands and eliminate young trees. Fire control activities were also a factor. In addition to the lack of periodic fires, young trees did not have to compete with grasses and other species for water, nutrients and light. Grazing and erosion also caused more rapid drying of the surface soils, which tended to favor deep-rooted species rather than grasses and forbs. In addition, livestock served as carriers for seed and trampled them into the ground. Another

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EXPERIMENT STATION

*Forest Service researchers and land managers view P-J harvesting on the Heber Ranger District, Apache-Sitgreaves National Forest, AZ.*

impact was that the loss of a protective plant cover led to accelerated erosion. Finally, livestock tended to concentrate along streams and in meadows, causing further site degradation. All resulted in increased tree cover in juniper savannahs and increased erosion and gullying.

## Control Programs

Recently retired Station Wildlife Biologist Kieth Severson co-authored, with Gottfried, a recent publication on distribution and management of P-J woodlands in the Southwest (see end of this article). He states that in the period following WWII, management efforts were begun to reduce pinon and juniper on western ranges. "By 1961, 1.2 million acres of Arizona pinon-juniper lands had been treated using a variety of techniques such as cabling, bulldozing, individual tree burning, grubbing and chopping. The treated sites were usually seeded with grasses," he said.

The authors explain the controversy over the value of pinon-juniper control efforts. "Past research results show that herbage yields can be increased by removing juniper trees. However," says Gottfried, "seeding is generally unsuccessful in large conversion areas. Research found that successful herbage production following tree removal depended on annual precipitation, amount of limestone in the soil, pretreatment tree cover and pretreatment soil nitrate-nitrogen content." In a New Mexico study, scientists evaluated a treated area after 20 years and found that the cover of grasses and forbs was greater in an undisturbed pinon-juniper stand than in a cabled area.

Control programs were also justified by the assumption that they increased water yield. However, while this mechanism works in vegetation types found on wetter sites, study results show that the basic moisture requirements on dry sites are similar regardless of vegetation, and one vegetation type is about as effective as another. Little opportunity exists for streamflow augmentation on warm, dry sites where annual precipitation is less than 18 inches and is exceeded by potential evapotranspiration. Most pinon-juniper woodlands fall into this category.

Gottfried talks about the common belief that the active erosion and gullying observed in the woodlands and the related decline in long-term site productivity are the result of the tree cover and lack of grass. "There is no evidence to support this hypothesis," he says, "and, in fact, research indicates otherwise. Erosion is a natural process and is accelerated due to reduced vegetation cover and overuse of channels and wet areas by livestock."

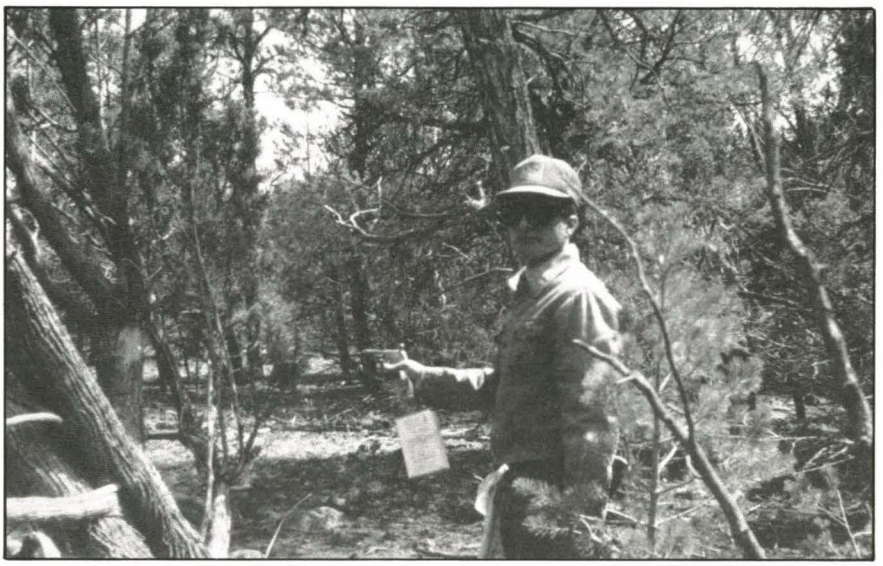
"Originally, it was anticipated that woodland control treatments would benefit wildlife because of increased forage; however," says Severson, "research found that treatment had a neutral effect on mule deer. The deer benefited from increased forage only when adequate hiding cover was available. I recommend small clearings interspersed within the stands to improve big game habitat," he said.

## Multiresource management

In the 1970's, a reevaluation of pinon-juniper management strategies began, partially because of the increase in fuelwood demands resulting from the oil embargoes. Some managers became concerned that the demand for fuelwood could eventually exceed available supplies. As a result, many began to consider the combination of sustained fuelwood production and integrated resource management, especially in mature woodland stands. In addition to the full array of products these woodlands provide, resource specialists began to realize that P-J ecosystems are closely connected to the culture and history of many rural and indigenous populations, and that their concerns must be integrated into land management plans. Managers then had to develop prescriptions that would meet their production goals and still produce or maintain productive and healthy stands. "Naturally, not all sites have the potential to produce the full range of resource benefits, and this factor too must be evaluated," says Severson. "Management procedures also must be developed that will allow natural resource management without damaging the large number of archeological and historical sites within the woodlands. Many questions about woodland ecology and management remain to be answered," he said.

## Silvicultural approaches

One chief goal in managing P-J is to obtain satisfactory tree regeneration for the future. Silviculture provides the tools for manipulating the woodland tree cover to sustain production of wood products and maintain woodland health. It can also be used to improve forage production and wildlife habitat and to create an aesthetically pleasant landscape. "We're



*Walt Thole, with the Heber District Timber Staff, marks trees for a single-tree selection prescription.*

currently evaluating the effects of several overstory and slash disposal treatments on overstory growth and development, tree regeneration, forage quality and quantity, small mammal populations, nutrient cycling and site productivity," says Gottfried. This work is being conducted near Heber, Arizona, in cooperation with the Apache-Sitgreaves National Forests.

Scientists are also attempting to develop prescriptions that provide integrated resource management. "So far, we believe that single-tree selection and two-step shelterwood methods are best for sustained stand health and productivity. These methods are compatible with the dispersal patterns of heavy tree seed, provide protected micro-sites for regeneration, and are aesthetically acceptable," Gottfried says. "On the other hand, clearcutting and the seed-tree method do not result in satisfactory regeneration.

## Wildlife-range approaches

Much of Severson's work focuses on the effects of P-J management on livestock and wildlife. "A careful assessment of wildlife and other needs must be made to ensure tradeoffs in resource allocation are acceptable," he says. "Clearing small dispersed areas of trees benefits elk, mule deer and livestock. Openings create a more diverse landscape that favor many wildlife species. For example, small mammal populations increase within cleared areas; birds that feed on mammals or insects associated with openings will also benefit from this landscape. Forage production also is stimulated in areas harvested using an overstory removal cut and in group selection openings. There is a need to define spatial and temporal patterns by habitat type that maximize plant and animal diversity.

Severson points out that treatments that reduce tree densities, such as the single-tree selection and shelterwood, should benefit livestock and native ungulates by providing additional forage while maintaining some degree of thermal and hiding cover. "However, different species respond differently to shade, for example, while total herbage biomass and blue grama biomass decline with increased canopy cover, the biomass of cool-season grasses such as pinon-ricegrass and New Mexico muhly actually increase with increased tree cover," he says. Further research relating herbage production to stand density is planned.

## Slash disposal

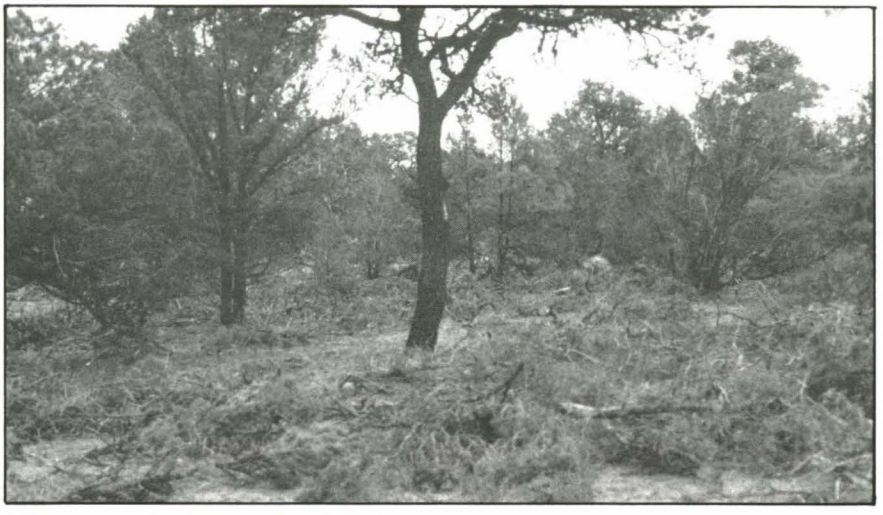
Gottfried and Severson note that slash disposal is another important issue in woodland management. "Disposal may vary according to management objectives," says Gottfried. "For example, burning in large piles is unacceptable because of the adverse effects on soils and overall site productivity. However, slash in small piles can be burned with the intent of creating areas containing earlier seral stages that increase floristic species richness on the treatment area. Other piles could be left unburned to provide habitat for small mammals. Slash can also be scattered in some areas to provide protection for herbaceous growth and to provide nursery sites for young trees. On other sites, scattered slash could be burned in a cool fire to promote temporary increases in nutrient contents of the herbaceous forage components. Finally, slash can provide some erosion protection by retarding surface water movement and by serving as a place where sediment can accumulate and not be lost from the site."

## Objective: forage production

While the wisdom of woodland control for production of forage for livestock on high-site public lands can be questionable, some private landowners may still prefer this option; and, some benefits of multiresource management can still be achieved. Fuelwood and other wood products can be harvested, providing a cash return and making subsequent activities easier and more economical. "One approach, even when livestock production is the main objective," says Severson, "is to create mosaics of tree-covered areas interspersed with grass-forb-dominated areas. Such a pattern favors a mixture of cool-season and warm-season grasses, is beneficial for wildlife and livestock and is often aesthetically pleasing."

Another approach is to create savannahs by retaining some of the larger trees from the original stand. Such savannahs can be more aesthetically pleasing than huge openings and still provide some limited wildlife habitat benefits as well as shade for livestock.

The scientists suggest that tree control to enhance forage production is easier to justify on low-site lands where management for tree products is not economically or biologically feasible. "Even when tree control is desired, managers should consider the size and placement of openings," they say. "Large



*Plots were cut to different basal areas, according to a single-tree selection prescription, to help study the effects of harvesting on P-J cone production, wildlife and forage production.*

openings are detrimental to deer and elk and to many nongame species. Mosaics of trees interspersed with cleared areas provide hiding and thermal cover for both wildlife and livestock. Regardless of the treatment and objectives on high- and low-site lands, proper grazing management is essential to successful range improvement activities."

Management of these woodlands, no doubt, remains controversial, but has evolved over the years to the current recognition of their value for many natural resources. High-site woodlands (those that can provide wood products on a sustainable basis) provide the best opportunities for multiresource management, including tree products, wildlife habitat, herbaceous production for wildlife and livestock, watershed protection, and recreation. "There are many gaps in our ecological knowledge of the pinon-juniper woodlands," says Gottfried, "and the full range of management options, linked to a recognition of habitat type differences, still needs to be evaluated." Management and research personnel continue to work together to ensure the sustained health and productivity of this important ecosystem.

For more information on this and related research, contact Gerald Gottfried, Southwest Forest Science Complex, 2500 S. Pine Knoll Drive, Flagstaff, AZ 86001, (602) 556-2107.

Additional details are available in the publication *Managing Pinon-Juniper Ecosystems for Sustainability and Social Needs,* General Technical Report RM-236, available from the Rocky Mountain Station.

# Hantavirus: prevention is the best defense

by Suzanne Graham
for Pacific Northwest
Station

*PCR-amplified Hantavirus RNA is placed into an automatic sequencer by a research biologist at the Center for Disease Control. (All photos courtesy of the Center for Disease Control in Atlanta.)*

The hantavirus caused major alarm in spring and summer 1993, when it first surfaced as an unknown but lethal respiratory illness in the Four Corners states of Arizona, Colorado, New Mexico, and Utah. With deadly swiftness, it struck formerly healthy young adults, initially causing ordinary flu-like aches and pains but quickly progressed to inflict massive tissue damage in the endothelial cells lining the lungs and causing capillaries to leak. Within a matter of hours victims went into crisis, finding it progressively harder, and then impossible, to breathe. Even with the help of a ventilator, many died from blood loss.

Through a combination of coincidence and quick and clever laboratory detective work that showcased the power of modern genetic techniques, researchers at the Center for Disease Control and Prevention (CDC) and the U.S. Army Medical Research Institute of Infectious Diseases were able to identify the culprit as a previously unknown strain of hantavirus.

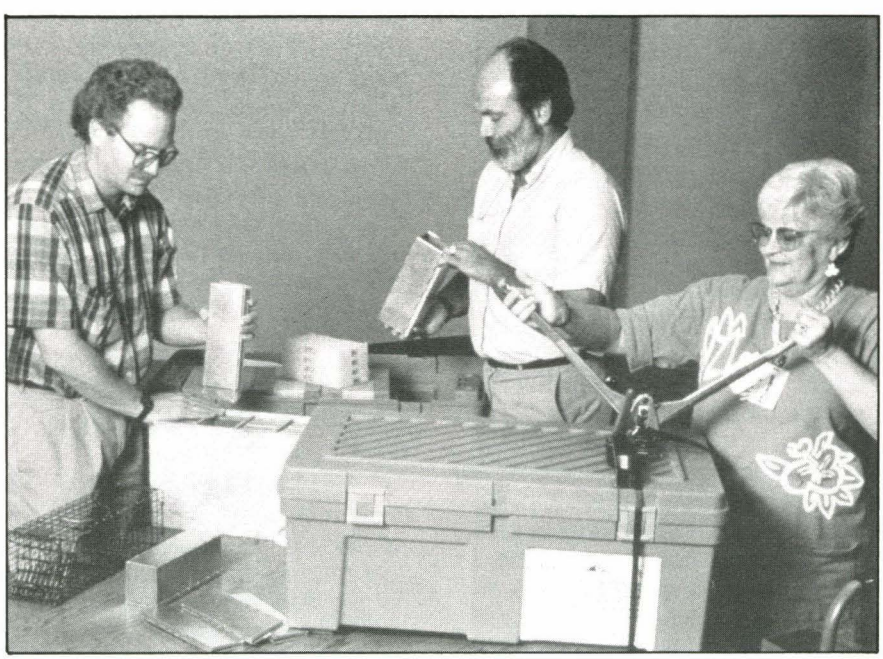
These are a family of retro-viruses already known in Asia and Europe for causing fevers with hemorrhaging and kidney disease. But the newly discovered U.S. strain—known as the "Four Corners" or "Muerto Canyon" strain, based on the location of the first cases—attacks the lungs rather than the kidneys, is much more rapid of onset, and more lethal; mortality for the U.S. strain is running at close to two-thirds, compared to a range of 5 percent to 20 percent for the overseas viruses. As of March 1994, the CDC, taking into account retrospective diagnoses from analysis of deceased patients' tissue samples as well as people currently presenting with respiratory illnesses, has recorded 64 confirmed cases, 39 of them resulting in deaths, according to Lori Armstrong, epidemic intelligence service officer.

## Deer mouse identified as main host of virus

Researchers have pinpointed the deer mouse as the main host for the virus, a cause of major concern, because the deer mouse range stretches across most of the continental United States and Canada. According to CDC's Armstrong, there are infected rodents all over the United States with the earliest sample retroactively identified as dating from 1975. "There is no reason to believe we won't find more cases."

That's also the opinion of Marcia Goldoft, medical epidemiologist with the Washington State Health Department. The concern in Washington State probably mirrors that of may other states currently having no recorded cases of hantavirus to date, but with large populations of deer mice. Goldoft's department has explored every available avenue to uncover cases of respiratory illness that might turn out to be caused by hantavirus. In the last 9 months, no case has surfaced. But Goldoft believes it's only a matter of time. "When there's been a confirmed human case just across the river in Oregon, another in Idaho just 10 miles from the Washington border, and another nearby in Great Falls, Montana, it stands to reason that we probably have some infected mice here too."

People seem to get the virus mostly from contact with the aerosols produced from deer mice urine, feces, or saliva. The infection can spread also through food or water contaminated by rodent excreta, or when other materials similarly contaminated come into contact with broken skin or any of the mucous membranes of the human body. So those who work outdoors in rural areas, such as farm workers, forestry and wildlife scientists, are potentially at risk. In particular, research biologists and mammalogists may face special hazards. The measures taken by certain Washington State wildlife scientists suggest an appropriate response to the potential danger, which field researchers in other states might do well to follow.



*Three members of the research staff at the Center for Disease Control prepare for a rodent trapping expedition to the Hantavirus endemic area.*

## PNW field crews follow stringent guidelines

Andrew Carey, a former researcher for CDC, is a Principal Research Biologist with the Pacific Northwest Research Station who has Forest Service field crews in both eastern and western Washington State. He quickly sent rodent samples from his region to the disease control agency. All have tested negative. Nevertheless, Carey's field crews now work under the stringent guidelines recommended by the CDC. They use surgical gloves when handling animals, traps, or bedding. They carry detergent and water, plus alcohol towelettes (since alcohol has been found to break the lipid code of the hantavirus). They use surgical masks or respirator masks plus coveralls that are removed before entering vehicles or houses. They cover any open wounds with waterproof bandages and observe strict hygiene rules, always washing with detergent before eating, urinating, or otherwise exposing any mucous membranes to the potential of aerosolized hantavirus.

"What precautions people take should be directly related to the risk they are undertaking," advises Carey. "The key is to inform people of the risks and the measures they can and should take for protection." He points out that the risk is not solely connected to direct handling of rodents and other small mammals. If field crews are searching for fungi in soil undergrowth, for example, they are in a potentially dangerous environment and need to take appropriate precautions.

## Risk factors discussed at workshop

Another Washington researcher who shares Carey's concerns is Sandra Martin, a research wildlife biologist with the Pacific Northwest Research Station who works in Kittitas County in central Washington State. Martin also sent rodent samples to the CDC for testings but has not yet received results. Nevertheless she also says, "It's a foregone conclusion that we have deer mice infected with hantavirus in this State—the probability is just too high to ignore." Like Carey, she believes that the danger extends far beyond direct handling of the rodents. Pointing out that one of the confirmed cases was a young bird researcher working out of a remote mice-infected cabin in the southern Sierra Nevada, she expresses concern about the overall lack of hantavirus knowledge among wildlife researchers.

*A research microbiologist performs one step in the ELISA antigen capture diagnostic test for Hantavirus.*

To help combat the confusion, Martin organized a 4-hour session on Vertebrate Research Hazards at the March 1994 annual meeting of the Northwest Scientific Association, 2 hours of which were specifically devoted to the risk factors and protection measures surrounding the hantavirus. At the meeting, held in conjunction with the Society for Northwestern Vertebrate Biology and several other scientific associations, field researchers also answered questionnaires and gave blood samples for a nationwide study by the CDC in cooperation with state Departments of Health to determine the infection level among high risk groups.

Questionnaire respondents also were asked if they could recall any colleague suffering from sudden onset of respiratory illness over the past few years. Samples and data collected at this and at an earlier Washington Wildlife Society conference have put Washington State in the forefront of representation in the national study.

Taking precautionary measures against the hantavirus causes some problems. Martin acknowledges the added inconvenience complicates already difficult working conditions. Carey points to extra equipment expense and the extra time needed to train field workers. Even then, he admits, the result is sometimes increased anxiety. "Some people are just not comfortable continuing to work with rodents once they

realize the risks, and then you have to deal with reassigning them to other research projects." Nevertheless, Carey and Martin believe the extra trouble is justified. They both hope that within the next 15 months, the CDC will have a better handle on the hantavirus. Things are looking promising: the agency, having isolated the virus in October 1993, is now culturing it. CDC scientists have injected the virus back into deer mice and hope to be able to determine how long it takes for rodents' urine and feces to carry the infection. They also are exploring how the virus is spread among deer mice communities. "From what we know about other viruses, we believe the main route of transmission is through males fighting and biting over territory, and then it spreads to females through courtship. But we're also exploring the possibility of vertical transmission of virus, from parent mice to offspring in utero," says Armstrong. Until more is known, she cautions, "any bodily fluid—saliva, urine, serum, blood—or any contact with the animal's tissue is suspect as a means of transmission of the virus." So for now the CDC's interim guidelines for risk reduction, which deliberately err on the side of conservatism, remain in effect.

## Guidelines provide safeguard against contracting virus

Those guidelines list safeguards that should be used by anyone likely to encounter infected rodents, such as rural householders or wilderness campers. General advice is to avoid coming into contact with rodents. For campers this means sleeping in tents with floors and sleeping surfaces at least 12 inches above the ground, keeping food in rodent-proof containers, using only water that is bottled or disinfected, burning or burying all trash, avoiding potential rodent nesting sites, and staying out of cabins or other enclosed shelters that are rodent infested until they have been cleaned and disinfected according to CDC guidelines.

For householders and farm or ranch owners, recommendations include washing dishes and cooking utensils immediately and removing all spilled food; storing food, animal fodder, and garbage in metal or thick plastic containers with tight-fitting lids; using steel wool or cement to cover all openings into the home with a diameter of more than a quarter-inch; placing metal roof flashing as a rodent barrier around the base of buildings and 3 inches of gravel under the base to discourage rodent burrowing; using raised cement foundations in any new construction; placing woodpiles 100 feet or more from the house and elevating wood at least 12 inches off the ground; cutting grass, brush, and dense shrubbery within 100 feet of the house; hauling away trash, abandoned vehicles, discarded tires and other potential nesting sites; and using spring-loaded rodent traps continuously.

When emptying rodent traps, or cleaning out rodent-infested areas, the CDC advises first thoroughly wetting the targeted area with disinfectant, wearing rubber gloves while removing the remains and placing them inside a plastic bag also containing disinfectant. Before final disposal, place everything inside a second plastic bag and then burn or bury it all or otherwise dispose of it according to local requirements.

Much of the above sounds extreme. However, the CDC predicts that "as we continue to find human cases and infected rodents, people will have to take more precautions." Carey also points out that apart from hantavirus, two of the biggest disease risks involved with handling animals in the wild are leptosporosis and tuleremia, and "the precautions we're taking against hantavirus provide some safeguards against these zoonoses as well." CDC Epidemiologist Armstrong, while acknowledging that most wildlife researchers and field workers don't wear respirator masks and surgical gloves at the moment, says that will have to change. In Washington State, it's already changing. In a state where no "cure" for hantavirus has yet been needed, at least some researchers have decided that informed knowledge and rigorous precautions may be the best remedy of all.

For more information contact Lori Armstrong, Center for Disease Control, 1600 Clifton Rd. N.E., Atlanta, GA 30333, (404) 639-1115.

# Scientists put small birds in the big picture

by David Tippets
Intermountain Station

First, we saved vital habitat for the large warm blooded mammals with big brown eyes—the bison, the elk, and the grizzly bear. Only a few mourned the extinction of the passenger pigeon. Then our ecological consciousness evolved in time to start saving wetlands for ducks and geese—generally large pretty birds that we could hunt and eat. But it took the dawning of a new age of ecological consciousness for society to become concerned about all the obscure little brown birds—the wrens, flycatchers, thrashers, swifts, and others whose names few people know.

Now, as "ecosystem management" and "landscape ecology" roll from tongues of resource managers with almost the same fluidity as "multiple use" and "wilderness," small land birds are getting their day in the sun. Their ecological status is just being illuminated just in time as we recognize the downward spiral of populations of some eastern species. In the West, scientists are just beginning to unravel the ecological mysteries of the neotropical migrants and small native land birds.

The Intermountain Station is focusing much of its wildlife research on two habitats critical for the conservation of neotropical migrant birds. Scientists are investigating the response of birds to timber harvest in old-growth forests, and grazing and recreation in riparian forests.

In southern Idaho and Nevada, Station Scientist Vicki Saab is leading several teams of cooperators studying birds in riparian habitat and burned coniferous forests. In Montana and northern Idaho, Station Scientist Sallie Hejl is investigating birds in old-growth coniferous forest habitats. Habitat values in both riparian and old-growth forests have been severely reduced and are still declining on western landscapes.

*Vicki Saab releases a yellow warbler caught in a riparian forest along Idaho's Snake River.*

## Declining riparian habitat

Upstream from Idaho Falls, the Snake River winds through a fertile floodplain that will likely never flood again. Palisades Dam controls the spring floods that till the seedbed and bury the seeds for new cottonwood forests. But before the dam tamed the floods, they created a riparian cottonwood forest spreading as far as two miles across the valley.

Before first light, Saab and her crew walk through the tangle of shrubs to permanently located plots to census songbirds. On a spring morning they will hear songbirds that few in our day hear and fewer yet will hear in the future.

Farmers cleared much of the forest where the valley bottom widened, leaving only the corridor along the river and scattered patches where old channels and rocky ground didn't yield to plows. Even with most of the area converted to farmland, what's left is still the largest cottonwood forest in Idaho, and perhaps the entire West.

## Idaho bird populations declining

For reasons not fully understood, a third of Idaho's migratory landbirds have declining population trends. More than half of all neotropical migrants in Idaho are associated with riparian habitats during the breeding season. "Riparian habitats are at great risk because of threats by livestock grazing, recreation, water control, and other land uses," Saab says.

Based on eastern studies, one could suggest that population declines are primarily related to habitat destruction, the problem of fragmentation, increased habitat edge, predation, and parasitism. But western riparian zones along streams and rivers may not fit the eastern model. In arid parts of the West with mountains and hills sloping down to narrow valleys, riparian areas have always been more edge than forest.

Have western songbirds, dependent on streamside vegetation, made special adaptations to living on the vulnerable forest edge that eastern forest birds have not? Saab's research will help answer that question.

## Grazing and recreation impacts

Habitat along the South Fork of the Snake provides a unique outdoor laboratory for Saab to study both grazing and recreational effects on neotropical birds. Some large isolated patches have no grazing and little recreational impact. Other patches are heavily grazed, and some patches next to the river are heavily used by anglers for camping and picnicking.

From this research, Saab is developing management guidelines for grazing and recreation that will help conserve neotropical migrants. In addition, a computer model is being developed to assess land-use impacts on bird communities in cottonwood forests. This model will allow biologists to predict population responses to activities that affect habitat condition, patch size, and surrounding landscapes.

## Old growth habitat in decline

The most obvious similarity between Saab's and Hejl's study areas are that they are both critical habitats that are declining in size and quality. Hejl is focusing on avian habitat relationships in old-growth and rotation-aged ponderosa pine and Douglas-fir forests in the Northern Rockies in Montana and Idaho. She is investigating populations within stands, between stands, between habitat, and across the landscape.

Hejl's work differs from many of the ornithologists that have preceded her in that she is using modern Geographical Information Systems (GIS) to get a better perspective on how bird populations and habitat interact on a large landscape scale.

The 1988 fire season in the Northern Rockies reminded us that natural forces often mold the landscape in a grand scale. The fires reshaped habitat structure on hundreds of thousands of acres at a time, not just in small blocks typical of changes induced by farming, logging, and urban sprawl.

*Intermountain Station Scientist Sallie Hejl looks and listens for small landbirds nesting in Northern Rockies coniferous forest habitat.*

## Landscape ornithology

"If landscape setting is important to individual bird species, this has profound implications for land managers," Hejl says. She explains that if landscape setting is critical, then forests can't be managed at the stand level with the expectation of maintaining viable populations of all bird species.

Hejl wants to know how the distribution and nesting success of birds in natural landscapes compare to populations in landscapes that have been segmented by roads, dotted with houses, and turned into patchwork quilts of clearcuts and second-growth timber stands.

"In order to maintain viable populations of each species, we need to know their distribution across the landscape," Hejl says, explaining that her focus on the populations ranges from the broadest landscape scale to foraging habitat for individual nesting pairs.

Hejl points to some research that suggests logging can either increase or decrease landscape heterogeneity, which results in positive changes for some species and negative changes for others. She cautions that logging can create the appearance of diverse habitat without actually increasing the biodiversity of avian species.

Before neotropical migrants or other species decline in population to the point that they achieve the same status as the spotted owl, she wants to help provide managers with a scientific basis for identifying key landscapes important for forest birds. Until her research is more complete, she offers managers an interim guideline.

"I suggest that land managers try to mimic presettlement landscape patterns as much as possible," Hejl says, "and the maintenance of such landscape patterns will probably maintain species that evolved in association with a particular landscape pattern."

## Summary

In both old-growth and riparian habitats, the Intermountain Station scientists are looking at broad landscape patterns and investigating the impact of fragmentation. Team members working in both States are studying the role of fire as a natural ecological process that shapes habitat. The Station's emphasis is to examine the contribution of various habitats to avian biodiversity and productivity at the landscape level for application in ecosystem management.

Ongoing research projects include:

- The recreational impacts on reproductive successes in relationship to changing vegetation structure and composition in a cottonwood forest.
- The effect of livestock grazing on breeding birds in cottonwood forests.
- Neotropical migrant bird nesting use of cottonwood fragments on the Snake River.
- Bird and small mammal responses to artificial revegetation of riparian habitats.
- Examining whether timber harvesting in forests with a history of modern fire suppression mimics natural fire conditions by comparing responses of birds and vegetation to these different disturbances.
- Grazing and small bird populations in selected riparian habitats.
- Investigating responses of neotropical migrant birds, and resident woodpeckers, to a 250,000-acre wildfire and the resulting salvage logging.
- Fragmentation effects on bird communities in old-growth western red cedar/western hemlock forests in northern Idaho.

*Research into the effects of fire as an ecological disturbance include influence on habitat for both migratory and resident woodpeckers.*

- Effects of "new perspectives" timber management and prescribed fire on autumn habitat use.

Recently completed research includes:

- The influence of landscape patterns on bird communities in old-growth ponderosa pine and Douglas-fir forests in the Northern Rockies.
- Bird communities in old-growth and mature second-growth ponderosa pine/ Douglas-fir forests.
- Pasture development on wintering grounds of neotropical migrants.
- Livestock grazing in high-elevation sagebrush.
- Birds in logged and unlogged western larch/Douglas-fir forests.
- A comparison of species detection rates from off-road and on-road point counts.
- "Idaho's Migratory Landbirds."

## For more information

Saab is associated with the Riparian-Stream Ecosystem Research Work Unit headquartered at the Forestry Sciences Laboratory in Boise, ID. That unit's growing emphasis is to develop partnerships to effectively investigate ecosystem processes and functions within a complete watershed perspective, putting ornithologists together on the same investigative team with foresters, hydrologists, geomorphologists, soil scientists, fisheries biologists and others.

Hejl is headquartered at the Station's Forestry Sciences Laboratory in Missoula, MT, and works with the Forest Wildlife Habitats Research Work Unit. The unit is developing expertise in the application of geographical information systems (GIS) tools and other methods correlating landscape trends with wildlife populations.

More information about Hejl's and Saab's research has been published in journals available at university libraries or from the other locations described below. If the listed journals are not available to you, or the publications that you need are in press, you may contact the authors for copies at the Forestry Sciences Lab, 800 Block East Beckwith, P.O. Box 8089, Missoula, MT 59807.

### *Hejl's Publications*


*Hejl, S. J. [In press]. Human-induced Changes in Bird Populations in Coniferous Forests in Western North America During the Past 100 Years. In: Studies in Avian Biology 15.*

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*Hutto, R. L., S. J. Hejl, C. R. Preston, and D. M. Finch. 1993. Effects of Silvicultural Treatments on Forest Birds in the Rocky Mountains: Implications and Management Recommendations. In: Finch, D. M.; Stangel, P. W. (eds.), pages 386–391. Status and Management of Neotropcial Migratory Landbirds; 1992 September 21–25; Estes Park, CO. Gen. Tech. Rep. RM-229. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.*

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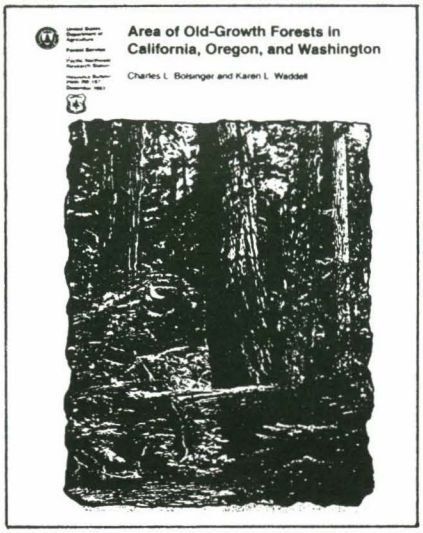
Old-growth forests in California, Oregon, and Washington cover about 10.3 million acres. Estimates were obtained for national forests, national parks, state parks, state forests, Bureau of Land Management land, U.S. Fish and Wildlife Service land, Native American land, and private ownerships. Oregon has almost half of the old-growth acres with about 5 million acres in seven different ownerships. More than 80 percent of the old-growth is on Federal land, primarily national forests. Old-growth occupied about half of the forest area when the first comprehensive forest surveys were made in the 1930s and 1940s. Less than 20 percent of the forest area is now old-growth.




Request *Area of Old-Growth Forests in California, Oregon, and Washington,* Resource Bulletin, PNW-197, available from the Pacific Northwest Research Station.

## Eastside forest ecosystem health assessment

In May 1992, Speaker of the House Tom Foley and Senator Mark Hatfield requested that the USDA conduct a scientific study of the forest health problems of eastern Washington and Oregon. The east-side forests had been suffering from a variety of health problems—primarily from insects and disease—affecting 3 million acres of Federal, state, private, and tribal lands.

In response to the request, the Pacific Northwest Station (PNW) led an interagency panel assigned to evaluate declining forest health. PNW Ecologist, Richard Everett, headed a team of 113 scientists from the Forest Service, University of Washington, Bureau of Land Management, The Nature Conservancy, U.S. Fish and Wildlife Service, and other agencies, organizations, and universities who contributed to this report. The results of the team's findings were published in the document, "Eastside Forest Ecosystem Health Assessment."

Their research provides the basis for a sustainable ecosystem management framework to evaluate the effects of management practices on ecosystem sustainability and recommends strategies for restoring or rehabilitating stressed ecosystems.

Request *Volume 1: Executive Summary*, General Technical Report PNW-317, from the Pacific Northwest Research Station.

# Trampling effects on mountain vegetation

Some plants resist trampling damage 25 to 30 times better than other plants, learned research biologist David Cole of the Aldo Leopold Wilderness Research Institute. Some plants will sustain damage with only light trampling while others show remarkable ability to withstand the repeated pounding of lug-soled boots.

Understanding the results of Cole's trampling research may help wilderness managers avoid impacts to fragile communities and suggest camping in the communities most able to survive. Unlike some believe, alpine plant communities prove to be more resistant to impacts than some plants at lower elevations.

They key to predicting resilience seems to be knowing where the plant's growing tissue is located in relationship to the soil surface. Plants that initiate growth at or below the soil surface absorb the stress of trampling better. For example, forbs such as *Geranium* would be permanently damaged more quickly than might the *Carex* growing next to it. This information can help managers to understand that even light trampling, occurring annually, could alter species composition in some communities.

Request *Trampling Effects on Mountain Vegetation in Washington, Colorado, New Hampshire, and North Carolina,* Research Paper INT-464, from the Intermountain Research Station.

# Acidification of Glacier Lakes

A three-year study on the major chemical components which determine acidification and acid neutralizing capacities has been completed on two high-altitude lakes in southern Wyoming. The researchers examined the hydrological and chemical fluxes within the system, and evaluated the concentrations of specific elements according to their relative concentrations on site and in precipitation events. They concluded that the lakes were moderately sensitive to acidification, but would require precipitation inputs as acidic as those in heavily impacted areas, such as in the eastern United States, in order for acidification to occur. They also noted that since contaminants are precipitated out early in the snowmelt process, seasonal acidification would probably occur at lower levels of inputs than for acidification on an average annual basis. For more information on this study, request *Acidification in the Glacier Lakes Catchments,* Research Paper RM-314, from the Rocky Mountain Station.

# Skidding damage studied

A recent study conducted on lodgepole pine stands in northern Colorado and southern Wyoming indicates that more than 50% of the trees on some plots have some damage due to skidding in intermediate cuttings, reflecting carelessness by skidder operators and ineffective timber sale administration. The study also assessed the most prevalent external defects on the trees, caused by such factors as insect damage, tree fall during windstorms, growing conditions, genetic stock, and injury from mechanized logging practices. Forked tops were found to be the most frequently occurring phenomenon, averaging 8.9% in all test plots. The researchers conclude that although partial cuttings are considered to be more esthetically pleasing than clearcuts, if tree harvest damage cannot be drastically reduced, partial cuts will be "repulsive" as well. For more information on this study, request, *Frequency of External Defect and Skidding Damage in Lodgepole Pine Stands in Colorado and Wyoming*, Research Note RM-525 from the Rocky Mountain Station.

## Desert tortoise food nutrients

The BLM is challenged with managing habitat for the threatened desert tortoise in ways that will help the tortoise survive. To be better able to base their management on science, the BLM approached scientists at the Shrub Sciences Laboratory in Provo, UT, needing information about the nutritive quality of plants growing in the Mojave Desert where it laps over the three-corners area of Arizona, Utah, and Nevada.

Some of BLM's critics claimed that domestic grazing degrades tortoise habitat. In response some defenders said that cow pies were the most nutritious food in the tortoise's diet. Others claimed introduced annuals and seeded grasses provided inferior food to native perennials. As the debate raged scientists studied which plants might contribute the most to the quality of the animal's diet and which ones in comparison yielded the least nutrition.

More scientifically stated, they studied the nutritive quality and mineral content of plants in three areas, and tested the hypothesis that plant mineral content is related to soil.

When the results were in, cow pies failed to demonstrate that they are the spinach of the turtle's diet, and annual forbs proved to be higher in nutrition than many native perennials, particularly some of the grasses considered desirable forage for livestock. Some perennial forbs and shrubs also proved superior to grasses for some nutrients. Most of the plants tested were in the normal range for their environment. Soil and topography didn't have as much influence in determining plant nutrition as some had supposed.

The knowledge acquired by this research will help manage habitat with consideration for nutrition—to the extent that the animal's nutritional needs are understood.

Request *Nutritive Quality and Mineral Content of Potential Desert Tortoise Food Plants,* Research Paper INT-473, from the Intermountain Station.

## Wilderness visitors with permits compared to those without

Brain teaser: Suppose you are a wilderness ranger standing on a high ridge looking down at visitors on opposite sides of the ridge far below you. One is sunbathing nude and the other is photographing wildflowers. Which visitor's permit would you hike down to check?

Answer: that depends on your objectives, but Social Scientist Alan Watson's research in the Desolation Wilderness in California suggests that a nude sunbather would more likely be in violation of a voluntary wilderness permit system than would a nature photographer.

You can make more valuable, although perhaps less fun, use of Watson's datum. Suppose you were going to collect information on your wilderness users through a voluntary permits system; would your sample equally represent all user groups? No, the study indicates you would sample some kinds of users more heavily than others.

Or let's say you want to distribute "Leave no Trace" literature by putting it in a brochure rack at the voluntary permit station at the trailhead. Would some users be more likely to get the message than others? Yes, campers, among others, would be far more likely to get your message than would anglers.

Watson's research, when compared to earlier studies, also shows that there can be differences between wilderness areas in which kinds of user groups voluntarily comply with a permit system. While some similarities exist, one should use caution in extrapolating user data between wilderness areas.

Request *Characteristics of Visitors Without Permits Compared to Those With Permits at the Desolation Wilderness, California,* Research Note INT-414, from the Intermountain Research Station.

To order any of the publications listed in this issue of *Forestry Research West*, use the order cards below. All cards require postage. Please remember to use your Zip Code on the return address.

Please send the following Pacific Northwest Station publications:
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2) *Acidification in the Glacier Lakes Catchments*, Research Paper RM-314.
3) *Chaparral Control in Mosaic Pattern Increased Streamflow and Mitigated Nitrate Loss in Arizona*, a reprint.
4) *Frequency of External Defect and Skidding Damage in Lodgepole Pine Stands in Colorado and Wyoming*, Research Note RM-525.
5) Other _____

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1) *Characteristics of Visitors Without Permits Compared to Those With Permits at the Desolation Wilderness, California*, Research Note INT-414.
2) *Mann Gulch Fire: A Race That Couldn't Be Won*, General Technical Report INT-299.
3) *Nutritive Quality and Mineral Content of Potential Desert Tortoise Food Plants*, Research Paper INT-473.
4) *Trampling Effects on Mountain Vegetation in Washington, Colorado, New Hampshire and North Carolina*, Research Paper INT-464.
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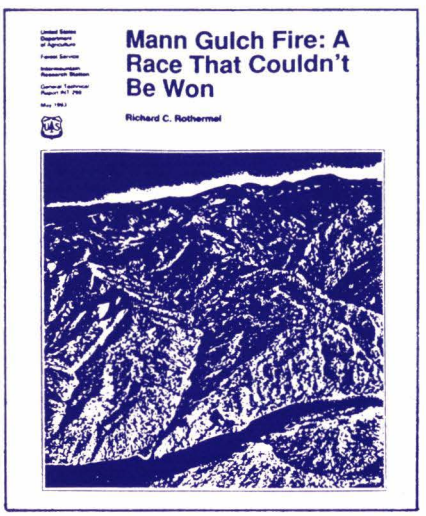
# Mann Gulch fire: a race that couldn't be won




Sixteen burned to death. Three escaped. The death of those smokejumpers on the Helena National Forest in 1949 provided the energy and commitment for the Forest Service to drive fire science from its infancy to its current sophistication.

Four decades after the flames caught the smokejumpers running up that rocky mountain side, fire scientists at the Intermountain Fire Sciences Laboratory in Missoula used the science that the deaths stimulated to recreate and describe the "race that couldn't be won."

Research Physical Scientist Dick Rothermel explains scientifically, but very understandably, the progression of events that killed 16 of the Forest Service's most elite firefighters. He makes a comparison to the 73 firefighters that deployed their fire shelters as the fire raced over them on the Salmon National Forest in 1985. The comparison illustrates how science, technology, communication, and training have all been combined to save lives.

The author of *A River Runs Through It,* Norman Maclean, asked Rothermel to help him understand the fire's behavior while he was doing research for a book in 1979. For several years Maclean returned to the fire lab every summer as he tried to recreate the Mann Gulch Fire in his mind. His book, *Young Men and Fire,* was a bestseller during 1992. When you read both Rothermel's General Technical Report and Maclean's book you can experience how science becomes drama.

Through the dramatic story of Mann Gulch many lessons can be deeply impressed in the minds and hearts of firefighters. Rothermel's report is important reading for anyone who ever has, or ever will, stand on a steep mountainside and feel a wildfire challenge them to a race.

Request *Mann Gulch Fire: A Race That Couldn't Be Won,* General Technical Report INT-299, from the Intermountain Research Station.

# Chaparral treatments increase water and nitrate loss

Edwin A. Davis, retired watershed research scientist from the Rocky Mountain Station recently authored *Chaparral Control in Mosaic Pattern Increased Streamflow and Mitigated Nitrate Loss In Arizona.* It appeared in the June 1993 Water Resources Bulletin of the American Water Resources Association.

This 16-year watershed study indicates that controlling chaparral cover in a treated area increases water yield, but also contributes to increased amounts of nitrate in the resulting streamflow. The study was the last of three undertaken on the Whitespar chaparral watersheds, located in central Arizona. The objective of the study was to see if annual discharge could be increased without degrading other resource values. Additionally, it was hoped that the heavy water-using chaparral could be converted to more shallow rooted grasses, which could also serve as forage for range uses. The 303-acre experimental watershed was treated with herbicides in a mosaic pattern which covered 55% of the acreage. Contact the Rocky Mountain Station for a copy of the report.

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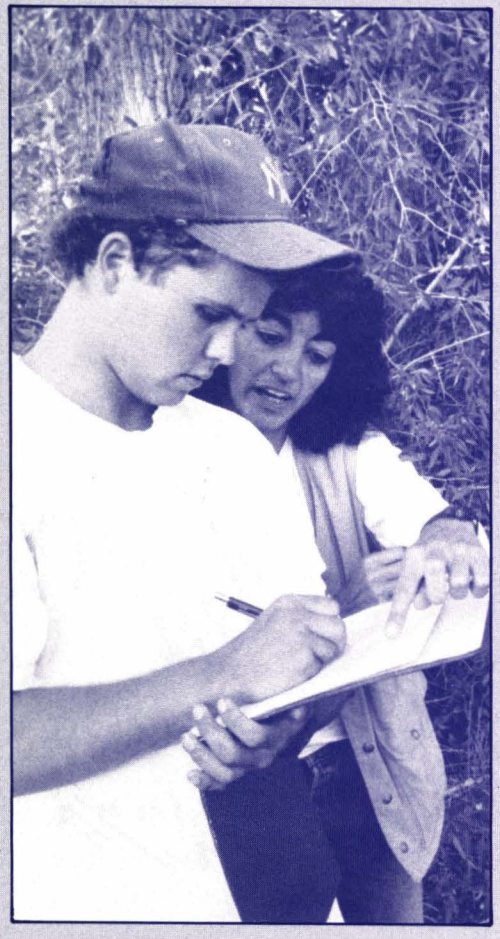

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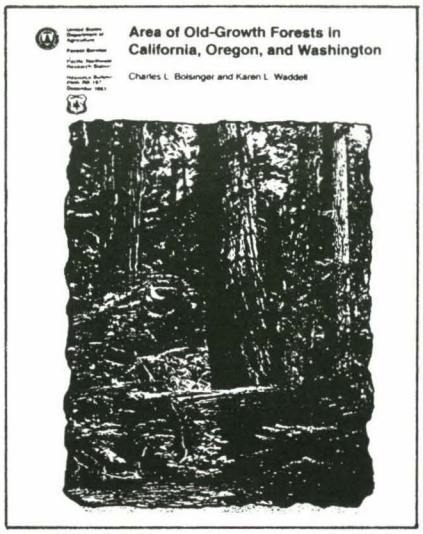


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Request *Trampling Effects on Mountain Vegetation in Washington, Colorado, New Hampshire, and North Carolina,* Research Paper INT-464, from the Intermountain Research Station.

# Acidification of Glacier Lakes

A three-year study on the major chemical components which determine acidification and acid neutralizing capacities has been completed on two high-altitude lakes in southern Wyoming. The researchers examined the hydrological and chemical fluxes within the system, and evaluated the concentrations of specific elements according to their relative concentrations on site and in precipitation events. They concluded that the lakes were moderately sensitive to acidification, but would require precipitation inputs as acidic as those in heavily impacted areas, such as in the eastern United States, in order for acidification to occur. They also noted that since contaminants are precipitated out early in the snowmelt process, seasonal acidification would probably occur at lower levels of inputs than for acidification on an average annual basis. For more information on this study, request *Acidification in the Glacier Lakes Catchments,* Research Paper RM-314, from the Rocky Mountain Station.

# Skidding damage studied

A recent study conducted on lodgepole pine stands in northern Colorado and southern Wyoming indicates that more than 50% of the trees on some plots have some damage due to skidding in intermediate cuttings, reflecting carelessness by skidder operators and ineffective timber sale administration. The study also assessed the most prevalent external defects on the trees, caused by such factors as insect damage, tree fall during windstorms, growing conditions, genetic stock, and injury from mechanized logging practices. Forked tops were found to be the most frequently occurring phenomenon, averaging 8.9% in all test plots. The researchers conclude that although partial cuttings are considered to be more esthetically pleasing than clearcuts, if tree harvest damage cannot be drastically reduced, partial cuts will be "repulsive" as well. For more information on this study, request, *Frequency of External Defect and Skidding Damage in Lodgepole Pine Stands in Colorado and Wyoming*, Research Note RM-525 from the Rocky Mountain Station.